H-A 64
Misc. Report
HOUSE

[No. 74]

THE UNIVERSITY OF MICHIGAN
DEC 1 6 1960
MAIN READING ROOM

REPORT

OF

SPECIAL SUBCOMMITTEE

ON

DEVELOPMENT AND PROCUREMENT OF NEW COMBAT AND TACTICAL VEHICLES BY THE DEPARTMENT OF THE ARMY

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES
EIGHTY-SIXTH CONGRESS
SECOND SESSION

NOVMEBER 16, 1960

Printed for the use of the House Committee on Armed Services

UNITED STATES
GOVERNMENT PRINTING OFFICE
57066 WASHINGTON : 1960

COMMITTEE ON ARMED SERVICES

86TH CONGRESS, 2D SESSION

CARL VINSON, Georgia, *Chairman*

PAUL J. KILDAY, Texas
CARL T. DURHAM, North Carolina
L. MENDEL RIVERS, South Carolina
PHILIP J. PHILBIN, Massachusetts
F. EDWARD HÉBERT, Louisiana
ARTHUR WINSTEAD, Mississippi
MELVIN PRICE, Illinois
O. C. FISHER, Texas
PORTER HARDY, JR., Virginia
CLYDE DOYLE, California
CHARLES E. BENNETT, Florida
RICHARD E. LANKFORD, Maryland
GEORGE HUDDLESTON, JR., Alabama
JAMES A. BYRNE, Pennsylvania
TOBY MORRIS, Oklahoma
A. PAUL KITCHIN, North Carolina
LEROY H. ANDERSON, Montana
DANIEL B. BREWSTER, Maryland
FRANK KOWALSKI, Connecticut
FRED WAMPLER, Indiana
SAMUEL S. STRATTON, New York
JEFFERY COHELAN, California

LESLIE C. ARENDS, Illinois
LEON H. GAVIN, Pennsylvania
WALTER NORBLAD, Oregon
JAMES E. VAN ZANDT, Pennsylvania
WILLIAM H. BATES, Massachusetts
WILLIAM E. HESS, Ohio
ALVIN E. O'KONSKI, Wisconsin
WILLIAM G. BRAY, Indiana
BOB WILSON, California
FRANK C. OSMERS, JR., New Jersey
KATHARINE ST. GEORGE, New York
CHARLES S. GUBSER, California
FRANK J. BECKER, New York
CHARLES E. CHAMBERLAIN, Michigan

A. FERNÓS-ISERN, Puerto Rico, *Resident Commissioner*

ROBERT W. SMART, *Chief Counsel*

SPECIAL SUBCOMMITTEE ON THE DEVELOPMENT AND PROCUREMENT OF NEW COMBAT AND TACTICAL VEHICLES BY THE DEPARTMENT OF THE ARMY

PORTER HARDY, JR., Virginia, *Chairman*

GEORGE HUDDLESTON, JR., Alabama
SAMUEL S. STRATTON, New York

WILLIAM H. BATES, Massachusetts
CHARLES E. CHAMBERLAIN, Michigan

WILLIAM H. SANDWEG, *Counsel*

DEPOSITED BY THE
UNITED STATES OF AMERICA

[No. 74]

REPORT OF THE SPECIAL SUBCOMMITTEE INQUIRY INTO THE DEVELOPMENT AND PROCUREMENT OF NEW COMBAT AND TACTICAL VEHICLES BY THE DEPARTMENT OF THE ARMY

INTRODUCTION

On May 19, 1960, the Honorable Carl Vinson, chairman of the House Committee on Armed Services, received a report, classified secret, from the Comptroller General, which set forth in detail the results of a review by the General Accounting Office of the development and procurement of new combat and tactical vehicles by the Department of the Army.

In view of the fact that this report encompassed a number of serious charges with reference to the Army's procurement methods in the tank-automotive field, as well as to the combat readiness of the Army as it related to the vehicles under consideration, Mr. Vinson, on May 20, 1960, appointed a special subcommittee to make an inquiry into the validity of the material set forth in this report.

The report in declassified form is set forth as appendix I in the printed hearings of the subcommittee and a summary thereof is set forth in the appendix of this report.

SUBCOMMITTEE ACTION

The subcommittee met in a special closed session on June 2, 1960, with the Secretary of the Army, Hon. Wilber M. Brucker, and the Comptroller General, Hon. Joseph Campbell.

The purpose of this meeting was to discuss generally the contents of the report and its implications as well as to attempt to definitize the areas of inquiry. It was the consensus of opinion that since the GAO criticism was directed generally at the Army's procedures for the development, procurement, and reporting, for all vehicles, and, in the case of the individual vehicles, the report referred to defects in the same general areas, that sufficient data to resolve this matter could be obtained by subcommittee consideration of a few vehicles, as representative of all nine, and concentrate its inquiry on them.

Accordingly it was decided to begin by considering the M48 and M48A1 medium tank, inasmuch as these vehicles represent, in volume, about one-half of the total procurement, of the nine vehicles mentioned in the report, and also because the medium tank is considered as the "workhorse" of the Army.

For this reason, the testimony taken concerned only that vehicle.

Because of the seriousness and complexity of the matters involved and in view of the fact that the GAO allegations alluded to a considerable quantity of Army documents reviewed but not set forth in

the report, the GAO was requested to present its case orally and to back up its testimony with evidentiary material wherever possible.

As a part of its presentation, the GAO prepared a series of exhibits, consisting mainly of copies of Army documents. This compilation of documents has been made a part of the files of the subcommittee.

As mentioned above, the GAO report was classified secret in view of some of the data contained therein. At the request of the subcommittee, the Army excised those passages of the GAO report which were classified and the subcommittee had, for its use, an unclassified version of the report.

The subcommittee determined that the deletions in no way detracted from or added to the GAO's presentation.

At the very beginning of the hearings, an incident occurred which caused concern within the subcommittee. Prior to official release of the report by the Congress, it was "leaked" to a midwestern paper. The news story referred to data set forth in an early draft of the report, which was not included in the final version the only one received by the Congress.

The Army and the GAO were specifically directed by the subcommittee to determine the source of the data. All efforts were negative.

The Army advised, after thorough review of the article, that none of the data printed was of a classified nature.

While the subcommittee firmly stands behind and upholds the principle of the right of the public to know, it strongly deplores the premature release of such data prior to receipt of testimony and official sanction of release by the appropriately designated investigative body of the Congress.

In order that the Army could "get on record" with its side of the controversy, the subcommittee took testimony from the GAO and the Army in executive session until a point was reached where the position of the Army was, for the most part, clarified.

At that time, the declassified version of the GAO report, together with the testimony taken to date, were simultaneously released to the press.

Thereafter, the hearings were all held in open session.

Historical developments

After World War II, production of tanks ceased and the plants created for their production were dismantled. Russia was still regarded as a friendly ally and the prospect of another war seemed remote.

As a result of findings and recommendations made by a War Department Board (Stillwell Board), a 5-year research and development program was initiated in 1946 to design and create a family of tanks with simplified and standardized components that would be superior in quality to any tanks that a potential enemy could produce.

By 1948 the world situation made it obvious that the national security could not wait for the culmination of the research program. The Army's battleworthy assets were alarmingly small and badly in need of overhaul and rebuild.

On July 1, 1948, a 4-year program was inaugurated to rebuild all economically reparable material so that all unserviceable equipment would be repaired by the end of fiscal year 1951. However, the following year, the Chief of the Army Field Forces reported that no

United States or British tanks, including those being overhauled or rebuilt, were capable of successfully engaging the most powerful Russian tanks on equal terms.

On June 25, 1950, the Republic of Korea was invaded and the possibility of a third world war was not overlooked.

In August 1950, a special subcommittee of the House Committee on Armed Services, under the chairmanship of Hon. Philip J. Philbin, inquired into the Army's tank program. The Philbin subcommittee found, what it termed a "deplorable" situation and stated that—

> Against the know capabilities of Russian armor, this Nation for all practical intents and purposes, is impotent.

It recommended an immediate go-ahead in the production of tanks.

At that time the Army was in the process of converting the M46 and had under consideration a new medium tank, which was 10 tons lighter and had a better gun and turret, the T42. The T42 had not been fully developed and manufacture of the actual pilot vehicle was still 6 months away.

The Army compromised between manufacture of more M46's or outright production of the T42 and began production of the M47, consisting of the M46 hull and the T42 turret. The M47 was considered by the Army as a definite improvement over the M46.

According to the Army, it was concerned about whether the M47 could prove itself in combat. Due to the lack of a heavy gun in the Army arsenal of weapons, it was decided to go ahead on the design of the M48 medium tank of not more than 45 tons, incorporating a 90-millimeter gun with quick removable gun tube feature, a range-finder, an 85-inch inside diameter turret race ring to permit incorporation of a larger caliber gun if required, low ground pressure and increased armor protection.

Procurement of medium tanks

Procurement of the M48 tank with 90-millimeter gun, was first contemplated early in 1950. With the beginning of the Korean conflict in June 1950, time became a most precious commodity. As the conflict increased in intensity, it became increasingly apparent that if the Army was to equip its forces with the required fighting tools, immediate procurement and production actions would have to be taken for tanks and other vehicles. On December 8, 1950, the first order for tanks was placed with Chrysler Corp. in the form of a letter-type contract.

The Army gave no reasons for the selection of Chrysler other than that time did not permit the long, drawn-out process of competitive procurement and Chrysler had been designated by the Army as one of a group of prospective tank producers since Chrysler had in its employ engineers who had done the same kind of work in World War II. Other companies, which had capable talent available, were assigned work by the Army in similar or other fields.

The original Chrysler contract, No. DA–20–089–ORD–8406, called for the development, acquisition of production equipment and tooling, and for production and delivery of a quantity of M48 tanks.

Under the provisions of this contract, the contractor undertook to engineer and design the tanks "in general conformity with the desires of the Government." The contractor's obligations were to be con-

sidered as fulfilled if he used his "best efforts" even if deviations were made from Government-furnished specifications.

No specific performance specifications for the tanks, as distinguished from design and material specifications, were stipulated as the responsibility of the contractor. He warranted only that the supplies would be produced in accordance with Government specifications. It was expressly stated that—

> The contractor assumes no responsibility for the performance of the said supplies, or otherwise, except for workmanship and materials supplied by it, and that the said supplies conform to detail designs and to specifications furnished by the Government.

In return, the contractor promised to "at all times act diligently and assert its best efforts."

Following the issuance of the letter contract to Chrysler, supplemental contracts, calling for tooling, production equipment, production and spare parts, were let, by letter, to General Motors Corp. (Fisher Body Division) and Ford Motor Co. in March 1951.

Design changes during production resulted in the designation of a number of these units as M48A1's.

In October 1954, Chrysler was the recipient of another letter contract for additional production of the M48A1. During production of the M48 and M48A1 tanks, a third version of this tank was designed. This vehicle contained a significant number of changes, including a modified engine and transmission and changes to the suspension system. It was designated the M48A2.

In November 1955, a letter contract for production of the M48A2 was awarded to Alco Products, Inc. Additional contracts for this vehicle were awarded to Chrysler Corp. beginning in May 1957. Production of the M48A2, by Chrysler, continued through December 1959, at which time the M60, the Army's latest medium tank, was phased into production by the Chrysler Corp.

Throughout the production history of the M48 series tank, Chrysler Corp. has held the design engineering contract (Vehicle Engineering Agency).

At the time of the Korean conflict, the Army stated that it did not have in its arsenal system the design capacity to handle the demand. It therefore contracted this work to civilian companies and utilized its arsenal engineers as inspectors and supervisors of the work performed.

The Army defended its use of the "best efforts" type of contract on the basis of its engineering review of the progress of design and production, which review was conducted throughout production by the Detroit, Watervliet, and Frankford Arsenals.

As an additional basis for defense of this type of contracting, the Army pointed to the reputation for integrity of the producers of the M48. On this basis it felt that the use of this type of contracting was valid.

The contract with Chrysler for additional production in October 1954 was the result of negotiation with Chrysler and Fisher Body. The Army had requested and received proposals from both producers and Alco, as well. (Ford had been requested to submit a proposal but declined to do so on the basis of its policy not to engage in production of a type of war material except in time of emergency.)

Although Fisher was in production at the time of this negotiation and would be until the contemplated beginning of the new production, Chrysler, which had already shut down, underbid Fisher and received the contract.

This is proof to us that when competition is sought and obtained by the Government, lower prices are the result. It causes us to wonder what better price the Army might have received in its original contract for the M48 if there had been some competition instead of a unilateral selection of Chrysler.

Although volume production was first ordered in early 1951, based upon the justification that the Korean emergency warranted "crash" procurement, a majority of the vehicles were delivered after the cessation of hostilities in Korea in the summer of 1953.

The Army testified that the scheduling of the procurement, production and modification of these vehicles was originally ordered prior to resolution of the Korean conflict. However, cessation of hostilities resulted in the assignment of the entire production of M48's and M48A1's to supplement the existing inadequate inventory rather than being for immediate use.

Results of production

The GAO's comprehensive review was directed toward the M48 and M48A1. The M48A2 was not included since it had only recently been issued to using troops. However, the GAO did make some observations in connection with this vehicle which were included in its report and testimony where pertinent.

According to the GAO, the Army (1) "rushed" into and continued in production of the M48 series tank without adequate testing; (2) these tanks presently contain defects which seriously impair their operation and maintenance; (3) many of these defects were found in initial models and throughout production and continue to exist in tanks now in use despite numerous and expensive corrective modifications.

The vehicles in question were produced at a cost of approximately $1.25 billion and initial production vehicles were defective to such an extent, according to the GAO, that they were not acceptable even for training purposes without extensive modification.

Official acceptance in May 1953 of the tank into the Army's family of vehicles as standard recognized that 49 corrections were mandatory before the vehicles would be acceptable for unrestricted issue to troops.

A report on tests of pilot vehicle No. 2, at Aberdeen Proving Grounds (APG) between April 1952 and January 1953 stated that the vehicle was unreliable, one failure occurring every 29 miles and a disabling failure occurring every 86 miles; additionally, that the vehicle "possesses many satisfactory features, however, many components are unreliable, unoperable, or difficult to maintain. Fuel consumption is high and cruising range short."

APG recommended that "an active development program be initiated to reduce fuel consumption and increase cruising range," stating that the cruising range of the M48 was considerably less than that of World War II tanks.

The GAO pointed out that the standardization of the M48 by the Army in 1953, although it listed 49 modifications necessary for un-

restricted issue to troops, did not appear to take into consideration many of the results of testing at Aberdeen.

One of the recommendations in the aforementioned APG report was that "all major deficiencies reported herein be corrected, prior to issue to troops."

While 60 percent of the failures disclosed at Aberdeen occurred in the track and suspension systems, most of the 49 modifications dealt with the turret and fire control systems.

The Army asserted that its "rush" into production was necessitated by its need to obtain a tank capable of meeting the demands of modern warfare. Since the design of the M47 was such that incorporation of characteristics to fulfill this need was impracticable, the new model had to be put in the hands of using troops as soon as possible.

Testing of pilot models and production were carried on concurrently with the result that changes in design, found necessary as the result of tests, had to be incorporated by modification at a later date.

As a result, it was not considered feasible to incorporate some changes into all production vehicles.

From the conclusions resulting from the analysis of tests, the Army stated that it determined that the numerous salient features of a new medium tank providing the required offensive and defensive capabilities necessary for modern warfare had been met.

Also, although test reports revealed failures in durability and need for essential modification in some areas, the Army expressed a belief that these could be corrected by later improvement prior to troop issue. This belief resulted in its standardization of the M48 in May 1953.

With an M1 cupola and a larger driver's hatch, the tank was designated the M48A1 in December 1954. Changes in the engine, improved turret controls and the addition of fuel capacity resulted in the standardization of the M48A2 in October 1955.

Some of the changes, which resulted in the designation of different models of the M48, the Army admitted, were not incorporated in previously produced models either because they could not, from an engineering standpoint, or because it would be too expensive.

The Army insisted that neither the Ordnance Corps nor Army Field Forces has ever alleged that these vehicles were totally unfit, at time of production, for immediate use. They could have been utilized, if necessary. Since the Korean conflict had diminished and the vehicles were not immediately needed, certain procurement and production problems were treated accordingly.

Subsequent to the Korean conflict, the Army devised a modification program to correct deficiencies uncovered during what amounted to a 3-year test and evaluation, and to incorporate improvements in the "state of the art."

At the time of standardization in May 1953 some 49 modifications had been identified as required for unrestricted issue to users. Subsequently, as production and field use continued jointly additional changes were approved. The total of such modifications numbered 128, of which 36 required no new hardware.

The Army denied that the M48 series tanks presently contain defects which seriously impair their operation and maintenance, and presented statements of field commanders upholding this position.

It alleged that the difficulties encountered by the users as reflected by the need for extensive maintenance and repair and replacement of parts, is not of unusual volume and is to be expected in so complex a piece of equipment. Also, that those deficiencies which could be corrected by modification were corrected or are being incorporated into production of the newest medium tank, the M60.

Modification programs

The Army Audit Agency (AAA) in its 1956 review of OTAC reported that—

> certain reported deficiencies have been, and continue to be, incorporated into current procurement programs which require repair or rebuild immediately upon acceptance from the prime manufacturers. These program deficiencies were reported mostly on three major vehicles: (1) Tank, 90-mm. gun, M48 * * *.

According to the GAO, although the Army developed corrections for a number of the original deficiencies, there was no effective control of the application of modifications. Substantial quantities of tanks were delivered to troops without modification, and the Army's records show that the Army could not readily identify which modifications had been applied to which tanks.

Because of this condition, the Army found it necessary to inspect all tanks in the field to determine the modifications still required to make them acceptable for unrestricted issue. This action disclosed that substantial numbers of tanks still required many modifications, involving thousands of individual modification kits. Some of these modifications still were being applied in 1958, while others of importance were not being made.

It was the position of the Army that the concurrency of development, production, and field use meant that during the early stages of the program there were in existence vehicles with varying numbers of approved modifications applied. In mid–1953 with the Korean pressure reducing, and the urgency of troop requirements diminishing, the Army decided to cease shipping unmodified tanks to troops or storage depots but, instead, to hold them in industrial depots and apply the modifications on a production line basis.

During the industrial modification phase, one-half of the total number of tanks produced were modified. Kits were procured from the tank producers and applied in the several industrial depots.

Since the other half of the total number of tanks had been shipped to using troops or storage depots with varying numbers of the approved modifications applied, the second, or field modification phase was initiated.

The Army knew with reasonable accuracy, according to testimony, the number of kits which had been applied to the tanks during production. It knew of the original shipping destination of the other tanks but it did not and does not maintain a record of transfer and retransfer in its central registration records office and therefore did not know the subsequent location of each of these other tanks by their registration number.

In order to initiate the field modification phase, a survey of all tanks in the hands of troops and in the storage depots was made in order to establish the basis for distribution of the proper number of kits to each location.

57066—60—No. 74——2

The first survey was made of tanks in the hands of troops, the kits procured, shipped, and applied by ordnance teams. A second survey was made of tanks in storage depots. Again, the kits were procured, shipped, and applied.

Since six of the modifications required heavy machine shopwork, the Army decided to defer these modifications until the individual tanks are ready to rebuild. At this time, a total of 754 tanks remain requiring the latter six modifications.

The Army does not require a report of action on every modification, because of the cost of obtaining this volume of information. However, it is currently exploring the feasibility of including a punched card in each modification kit for transmission to the responsible technical service when the modification is applied.

The Army policy on the application of modifications is intended not only to correct deficiencies but also to promote product improvement, by applying necessary modifications to keep equipment modern as technology advances and tactics change.

It is important to distinguish between different circumstances under which modifications may be applied to Army equipment. Some modifications occur during production of an item. These are phased as engineering changes into the production line under the direction of the Chief of Technical Services after due consideration is given to such factors as urgency, cost, effect on delivery schedules, and obsolescence of parts. Others are introduced after a piece of equipment has been produced and issued to the field.

Decisions to modify equipment after production stem from continuing and careful analyses of deficiencies reported or improvements suggested by field commanders and other using and testing agencies.

Under existing Army policy, modification of equipment will be considered only when one or more of the following criteria are satisfied:

(1) It is required to promote safety of personnel;

(2) It will prevent serious damage to equipment;

(3) It will enhance combat or operational effectiveness significantly; or

(4) It will materially reduce maintenance costs.

Along with these criteria, consideration is also given to the cost of the proposed modification, the availability of funds, priority in relation to competing demands and the possibility that the equipment to be modified may be replaced by a new model in the near future.

If the modification must be applied promptly to all items, it is classified "urgent"; if not, it is classified "normal" and may be accomplished as soon as feasible within available resources.

No one, least of all this subcommittee, would quarrel with the Army's criteria for modification. The need for extensive modification and the cost thereof, is discussed in various places in this report and will not be repeated here.

However, the Army's statement that it does not require a report of action on every modification, because of the cost of obtaining this volume of information, is not understandable.

The criteria under which a modification is considered and approved is such that its application is a "must." Therefore, control or surveillance of this program is also a "must."

Army Regulation 750–5, dated October 28, 1957, as amended, places responsibility upon OTAC for determining when a modification is required and upon the field commander for the installation of modification kits. The AAA in its 1960 review of OTAC determined that this procedure has not been effective of the desired results. From a sampling of 23 modification kits, all of urgent classification, AAA determined that there still remained in depots, stocks of 8 of these items, some of which having been procured as early as 1955, were subject to disposal actions inasmuch as the applicable modification work orders have been canceled.

It is not known whether any of these modifications concerned the M48 series tank and whether they did or not is irrelevant to the point at issue. The plain fact is that there is not now an effective followup of a program of vital importance, and obviously there should be. Certainly, the cost of including in each modification kit a punched card to be returned to OTAC when the kit is applied, presently being considered by the Army, and such other costs attendant to the maintenance and control of this program, are insignificant when compared to the loss incurred by failure to apply a needed modification and to the further loss by disposal as surplus of items procured for such kits when they are not used.

Costs of modification

The GAO found it impractical to determine any reasonable approximation of the cost of modifying vehicles since the reports and records of the Army and those of the contractors were not designed to reflect the extent of modification expense for a particular series of vehicle.

Review of the records of the prime contractor at a plant where a substantial number of tanks were manufactured and modified gave an indication of the substantial amounts that were involved in the modification programs. Two types of tanks (heavy tanks, M103, and medium tanks, M48 and M48A1) were both manufactured and modified at this location. Production of these two types of tanks was included in one contract, and modification expense of both was included in another. Reports to the Ordnance Corps did not identify the total cost of modifying either of these tanks.

The records of the prime contractor showed, however, that modification of about 2,000 M48 and M48A1 vehicles cost about $26 million or about $12,000 per vehicle. The cost of modification at the numerous other locations involved was not determined by the GAO. However, production by the prime contractor ran concurrently with production at the two other original contractors' plants. The design and engineering work was performed by the prime contractor, and GAO assumed that all vehicles produced under the first three contracts required similar modification. Indications were that modification expense for this production was about $100 million. Additionally, much of the needed modification was not included in this program. For example, modification of the commander's cupola was being per-

formed in late 1958 and early 1959. Application of a needed modification to the suspension system, a change in the compensating idler, is still being considered, and has been variously estimated to cost between $11 million if applied only to a certain quantity of the vehicles, and $56 million if applied to all vehicles.

With respect to cost of the modification program, the Army testified that the cost of the 231,001 kits procured from the vehicle producers and the cost of kit application by contractors is reflected accurately in Army records as $65,833,825. The cost "in house" for application by military and civilian application of kits is "estimated" at $10,050,000. A total cost of $75,883,825.

It appears that the Army's estimate of the cost of the modification program for the M48 series tank may not be all inclusive. The AAA, in 1956, reported that—

> obligations incurred in connection with the modification of the tank, 90-millimeter gun M48, which can be tentatively identified, total over $100 million to date. * * *

Since additional modifications were made to this vehicle subsequent to fiscal 1956, it can only be assumed that the final cost of modification is in excess of that indicated above.

Vehicle engineering agency (VEA)

One phase of the procurement process, related to the design, development, and production of quality tank-automotive equipment, is the selection of the vehicle engineering agency. A commitment of this nature generally follows the design and development phase and is for the purpose of engineering and redesign of components to eliminate components or to add improved features as necessary throughout the production phase of the vehicle. It includes preparation for quantity production, drafting of drawings, and specifications for supply procurement, as well as participation in the testing of vehicles to evaluate performances.

Since it is logical to have available a source of talent with knowledge of the vehicle, the design and development contractor is often selected as the VEA. In this instance, as noted above, Chrysler has been the VEA for the M48 series tanks.

In its contract with Chrysler for VEA services on the M48 series, the Army included a service which involved the use of field technicians sent to various using troops to gather performance data on tanks in operation. This is over and above that VEA activity described in the preceding paragraphs.

These representatives, as they are called, are sometimes sent on a particular mission to review the performance of a particular item and are sometimes instructed to direct their attention to a particular group of tanks receiving special usage.

Generally their duties are, according to documents supplied at the request of the subcommittee by the Army, to (1) collect all failures and deficiencies occurring at the post, camp, or station where they are assigned; (2) analyze all problems encountered and establish respective causes and symptoms; and (3) report all activities weekly by submitting a weekly progress report.

These overall duties are frequently augmented by subsequent instructions, either oral or written.

Thereafter, the data collected by the VEA representatives are correlated with that received from other sources and forwarded to OTAC for analysis and possible action.

We find no fault with the concept of the VEA during production and testing, and believe it a necessary part of the procurement process. However, from the data furnished during the hearings and from a review of weekly reports of field representatives, it appeared that this latter activity was duplicative of that already provided for by Army regulation.

Under questioning, the Army admitted that it could provide these data within the existing framework of its reporting procedures but was deterred therefrom by limitations of personnel and allocations of moneys.

We believe that such activity should be done in-house, wherever possible. As a rule, it is less expensive and the Army can exercise greater control over the activity and the personnel connected therewith.

Reporting system

The Army, in its reporting complex within the tank-automotive field, testified that this complex includes test agencies, Ordnance Corps maintenance technicians and regional representatives, military and civilian field liaison personnel, maintenance engineering personnel, depot surveillance representatives, VEA representatives, and EAM punchcard reporting and analysis system. This latter system was developed by OTAC in June 1958 and initiated in March 1959. It has not yet been fully implemented.

Among its many reporting forms, the Army utilizes a system of unsatisfactory equipment reports (UER) to reflect a deficiency discovered by using forces as a result of one or more specific conditions. These conditions do not include failure of an article by reason of "fair wear and tear."

The Army stated that all of these groups, considered together, comprise a complete failure reporting system which OTAC feels does provide the data failure required for a suitable means for evaluating the effectiveness of the vehicles after their issuance to the using forces.

The subcommittee concerned itself generally with the VEA field representatives, the UER, and that portion of the maintenance records maintained by the using troops designated as the organizational equipment file or vehicle jacket.

VEA field representatives

The scope of the activities of the VEA are discussed elsewhere in this report as is the fact that in the absence of certain restrictions, personnel ceilings, and funds, the Army feels that it could handle that portion of the VEA work performed by the field representatives.

Perhaps the most notable fact disclosed concerning VEA reporting of vehicle failures was brought forth when the Army and the GAO attempted to reconcile repair and replacement data, for a certain group of tanks. These data were taken by the Army from VEA records

and by the GAO from Army maintenance records. Despite the fact that the VEA may not be obliged to report all failure data, especially that which would be attributable to "fair wear and tear," it was noted that some replacements and repairs of major components, apparently not as a result of "fair wear and tear," noted by the VEA, did not even appear in Army records and vice versa. All in all, it was a most confusing situation and one which the committee found impossible to understand.

Also, in this connection, it was noted that the VEA, in its reporting system lists four categories for reporting of failures, A, B, C, and D: A and B were those which the representative personally viewed and investigated, while C and D were those not viewed but reported to him and not investigated. An additional qualification of the C and D categories of failures stipulated that "C" failures were learned from a reliable source and "D" failures from a source of questionable reliability. Who would fit this latter category we do not know.

The subcommittee views this as a rather unsubstantial basis for reliance by the Army.

It was explained by the Army that the VEA field representative could not be everywhere on the post or station at the time these vehicle failures occur. With this observation, we wholeheartedly agree. We also believe that reliance should not be placed on such an incomplete reporting system.

Unsatisfactory equipment reports

The UER system represents a formal complaint against an item of equipment by the soldier in the field or his maintenance support activity, or by anyone, anywhere in the Army. It is designed to cover only obviously abnormal conditions involving improper design, faulty material, poor workmanship, excessive wear or deterioration, and safety hazards.

This system would be of material assistance to the Army in its efforts at vehicle performance appraisal if properly used. However, there is some doubt as to the extent of usage by the troops and timely consideration and action by the recipient, OTAC.

In 1956, the Army Audit Agency (AAA) prepared a report on its review of OTAC. Included therein was the result of the Agency's consideration of the UER system and the results attained by OTAC's use thereof.

The AAA found not only a lack of timely action on user complaints but also found, in some cases, replies to the complainant that gave the impression that OTAC was inclined to "sluff off" many complaints. In addition, the AAA was unable to trace a number of UER's which OTAC had determined required both engineering change orders and modification work orders, from maintenance engineering files to the Product Engineering Section. While this did not always mean that the work was not accomplished, it did reflect a breakdown in the supervision exercised over the handling of UER's, to assure followup and timely correction of equipment deficiencies in the hands of troops.

In its 1960 report on OTAC, the AAA reported that improved procedures at OTAC had been developed and implemented which pro-

vided for closely controlled analysis of deficiencies reported by the field and issuance of modification or repair instructions in a timely manner. However, it was then determined that field activities are not now prompt in reporting unsatisfactory vehicle conditions, thereby precluding OTAC, to some extent, from its maintenance responsibilities. "Vehicles in the supply system are known to require corrective action at the OTAC level but have not been reported."

In view of the findings of the 1956 AAA report, this is not at all surprising. Undoubtedly, the using activities have received the impression that it is a waste of time to send UER's to OTAC. Reportedly, OTAC engineering, field service and maintenance personnel advised representatives of the AAA that "the unsatisfactory equipment reports (regarding the M48) rendered by the using forces in the field were exaggerated."

In our own experience, after learning of the dissatisfiaction of the gun crews with the operation of the .50-caliber machinegun, we inquired as to the number of UER's submitted to OTAC on this item since 1956. We learned that only three UER's pertaining to the machinegun and its feed and ejection system have been received by Ordnance since 1956—two from the Army and one from the Marine Corps. This was proof positive that the UER system is not serving the purpose for which it was intended. Any conclusions reached as a result of dependence thereon are questionable.

The present concern of OTAC over prompt action in UER's is much like locking the barn door after the horse is gone. It is going to take an intensive selling job to the troops to get them to comply with this phase of the Army's reporting program if it is to remain in the system and be effective.

Vehicle jacket

The organizational equipment file, or vehicle jacket, is an envelope in which are filed records of the performance of preventive and command maintenance, technical and spot check inspections, and any other records pertaining to maintenance of the vehicle. This file is issued with the vehicle as a part of its equipment and is maintained by the unit to which the vehicle is assigned.

In addition to being a file for vehicle maintenance records and reports, the face of the vehicle jacket is arranged to show major assembly replacements and the application of modifications as well as the dates of such action.

According to Army regulations, the jacket is to be maintained completely and for the life of the vehicle and is to be destroyed only upon final disposition of the vehicle through sale or salvage. If the jacket is to be replaced for some reason or other, all information is to be transferred to a new jacket.

We inspected a number of these jackets and came to the only possible conclusion—they are not being maintained in accordance with instructions. The Army, in its testimony, agreed with the GAO that there is room for improvement here and it intends to develop an improved file.

With that we agree and direct the Army's attention to a similar file maintained by the Marine Corps which it identifies as the tracked

vehicle logback. Instructions for the assembly, maintenance, and use of this item are set forth in Marine Corps Order No. 8005.2 sup. 23, dated September 2, 1959.

We inspected a number of copies of this book presently in use on tanks at Camp LeJeune and determined from discussions with the tank commanders, who maintained these books, that this is an easily maintainable and highly informative item of recordkeeping.

Tank commanders testified that it requires no more than 5 minutes per day to record the necessary entries and that the book contains a complete history of the vehicle from the date of manufacture. An inspection of the items entered therein revealed the book to be an invaluable and prime source for determining the performance reliability of an individual vehicle. We believe that a controlled review of such a record would provide the best and most accurate analysis of dependability for logistical planning and would likewise serve as an excellent basis for purposes of procurement. Coupled with other records containing data reflecting engineering problems and their solution, and maintenance and supply matters, it should serve as the keystone of Ordnance activity in supplying a quality item to the user.

The Army's most recently established EAM punchcard system, which has not been fully implemented, is described in Ordnance Inspection Handbook, ORD–M608–T16. The purpose of the system is to serve as a data feedback for Ordnance tank-automotive equipment in reporting defects which affect vehicle performance and/or reliability. Since it includes data reflecting extent of use, mileage and hours, as well as the conditions of use under which the defect occurred, it appears to be the most complete of the Army's records yet devised to allow for a determination of reliability.

However, unless the analysis thereof is married to consideration of the supply and availability of spare parts and the extent of capability of maintenance under conditions as closely approximating combat as possible, it will avail nothing and become just another record.

The Army, in its testimony, gave credit to suggestions made by the GAO, during its review, for stimulating the Army into devising this system.

Operational failures

A review by GAO in April 1959 of field-use records at 3 military locations where substantial numbers of tanks were in use, resulted in its submission to the subcommittee of the following tables which summarize the results of its review:

Location	Vehicles on hand	Number of vehicles reviewed	Average number of months reviewed	Total miles driven	Average miles per month per vehicle	Performance failures	
						Total number	Average per 100 miles of operation
Site A	80	21	7.4	4,534	29.2	137	3.0
Site B	113	64	13.8	51,747	58.6	1,311	2.5
Site C	306	212	8	21,341	12.6	662	3.1
Total	499	297		77,622	28.4	2,110	2.7

While each of the failures listed above do not necessarily represent trips to the maintenance shop, they do reflect actual failures of vehicle parts, which impair the operational effectiveness of the vehicles (GAO report).

These failures were reported by the VEA (contractor) at site B, and were shown in Army maintenance records at the other locations.

The 1,311 failures reflected in the VEA records at site B consisted of the following categories:

	Number	Percent of total
Automotive:		
Engines:		
Power	49	
Auxiliary	116	
Total engines	165	
Final drive	41	
Transmission	29	
Track and suspension	552	
Total automotive	787	60
Armament:		
Turret	106	
Sighting and fire control	40	
Arms	70	
Total armament	216	16
Hull and accessories	86	7
Electrical	28	2
Not identified	194	15
Total failures	1,311	100

The Army took exception to the GAO compilation of vehicle "failures" at the three sites visited by the GAO and prepared its own charts utilizing records of the vehicle engineering agency at all three sites, since Army maintenance records were no longer available.

In the case of site B, the Army determined that over the same period (Feb. 1, 1958 to Mar. 24, 1959), as utilized by the GAO, the VEA records for all of the 113 tanks reflected a total of 1,615 failures of which 73 were of the disabling type. Since these vehicles aggregated a gross total of 91,530 miles for the period reviewed, the tanks operated 1,254 miles per disabling failure and averaged about 58.8 miles per tank per month.

The Army described disabling and nondisabling failures as follows:

By "disabling" we meant the kind of failures that would prevent the tank from fighting. In other words, with this kind of failure, the tank could no longer move, shoot, and lay its main armament or accomplish its mission; in other words, what the tank had been designed for.

In the other category "nondisabling," we collected all the other failures that represented items that the tank crew by and large could repair in time, between their activities in connection with combat.

The Army was critical of the GAO statistical results because of the lack of this or a similar mitigating factor.

Secretary Brucker spoke of this and referred to the GAO tabulations of vehicle failures as—

* * * a conglomerate of minutia * * * a mere numbers game * * * that is not significant of anything.

57066—60—No. 74——3

Specifically at site B, the Army compiled the following statistical breakdown of failures:

	Disabling	Nondisabling
Powerpack	40	58
Suspension	11	503
Armament	13	153
Hull	9	449
Turret	0	123
Electrical	0	256
Total	73	1,542
	1,615	

In addition to its breakdown on the type of failures at site B, the Army pointed out that this is a training area and that tanks at this site are subject to much greater use and abuse because of lack of previous driver training on the part of the user and should be expected to have a greater incidence of breakdown.

Additional descriptive data relative to the vehicle failures compiled by both the GAO and the Army have been recorded and made a part of the subcommittee files.

In deference to the Army's contention that site B is a training area and tanks so used should be expected to have a greater incidence of breakdown, we requested similar data from the Marine Corps at Camp Lejeune, N.C., which has a complement of M48A1 gun tanks. In order that the results would be as realistic as possible and representative of all tanks, data was extracted from the records of the most representative platoon.

It should be noted that operational data concerning Marine Corps tanks, because of their usage, should reflect, as near as is possible, the probable occurrence of operational failures in combat.

The Marine Corps compilation reflected 96 nondisabling and 23 disabling failures for this group of 17 tanks over the period of fiscal year 1960. In testimony, the Marine Corps advised that it follows a program of replacement of vehicles, rebuilt for used, on a regular basis, as follows: When the tank is 4 years old or it has had 400 to 500 hours of hull usage, it is sent to the Marine Corps depot for rebuild and another is issued. Experience has indicated to the corps that on the average, engine life is about 1,000 miles, track life 600 to 1,000, and sprocket life 500 miles. These and similar items are generally replaced by local maintenance when these averages are reached.

We have no desire to take part in a numbers game or to attempt to decide on a statistical basis that the M48 is not a reliable or dependable vehicle. We did, however, receive one very definite impression from a close review of these items and the data submitted therewith—that these vehicles require a tremendous amount of maintenance on all levels, if they are to accomplish their intended mission.

There is no question that both the Army and the Marine Corps are excellently equipped to perform the required maintenance in the shops as well as in the field of combat. Their capability in this category is very good and obviously is the result of long and careful planning and study.

What is distressing, however, is the realization that these vehicles require this amount of maintenance. Every error in design places an added burden on an already very complex problem of repair and supply. When consideration is given to the advances in technology and the major breakthroughs accomplished in other fields since the end of World War II, it is surprising that the "state of the art" has progressed so slowly in the automotive field. It is true that there have been advances in some areas, such as standardization of parts, the introduction of the automatic transmission and similar hydraulic systems and in other parts of the vehicle as well, but the operating life of these and other components has advanced at what appears to be a snail's pace. It is surprising to note that in the present-time frame the Army states it has reached the 2,000-mile plateau and is attempting to reach a goal of 4,000 miles of operation, in the field of tracked vehicles, before major overhaul. However, it offered no data to prove this statement, insofar as field use is concerned.

The M60 allegedly has reached the 4,000-mile goal but has yet to prove itself by extensive field usage.

Where does the responsibility lie? We realize that an invention cannot be scheduled but certainly this country is not devoid of talent in this area. We have taken particular note of the fact that the M48-series tanks, with one exception, were manufactured by the automobile industry. Where are the "off the road" equipment manufacturers in this picture?

Except for the production of some oilfield, farm, and like equipment, the automobile manufacturers have little experience in the three basic factors which contribute mostly to the short life of tank components—size, weight, and off-the-road operations. As the roads of this country have improved, their experience has lessened in proportion. Not so the off-the-road equipment manufacturer—his experience has increased by the construction of these very roads.

The Army, at the request of the subcommittee, supplied a listing of concerns employed by Ordnance Corps as vehicle design agencies during the Korean war period. The off-the-road manufacturers are listed in connection with such items as cargo carriers, personnel carriers, recovery vehicles, gun platforms, and trucks, but no tanks. Why this is so, we are not in a position to state. To us, a tank appears to have many more properties comparable to a crawler-tractor than it does to a sleek, high-powered, shiny automobile. We sincerely trust that the wealth of experience and talent in the off-the-road manufacturing industry has not been overlooked in the tank field.

We believe and recommend that both the Army and the automobile manufacturers take a long, introspective look into the part each has played in the design and development of this item of equipment and ask themselves this question: Have we been remiss in any manner?

We are not alone in this belief that there is a need for soul-searching appraisal of past approaches to this problem. Maj. Gen. Nelson M. Lynde, Assistant Chief of Ordnance for Field Service, in an address before the annual meeting of the Combat and Tactical Vehicle Division of the American Ordnance Association at Detroit, Mich., on May 14, 1959, stated:

It has been the popular belief for too long that the development of military vehicles compatible with the Army's requirements will come about as a free byproduct of normal progress in the civilian automotive industry.

Status of current deficiencies

In many cases, the Army stated, the deficiencies pointed out by the GAO were known to exist but were considered to be minor in nature by the using forces. These deficiencies are normally corrected by attrition, rather than through a modification program. For this reason, deficiencies continue to be reported until such time as the vehicle is beyond the capability of field maintenance and is returned to the depot for complete rebuild. At the time of rebuild, about 85 to 90 percent of vehicle life is restored to the tank.

According to data furnished by the Army, it—

> overhauls a tank only about two times. It would, for example, be overhauled once at the most for reissue to the Regular Army or for issue to Reserve components. It would be overhauled again when withdrawn from the Regular Army or from our Reserve components for grant aid or military sale to one of our allies.

Cruising range

The Army testified that the air-cooled 1790 series engine and cross-drive 850 series transmission were developed to meet requirements for a unit powerpack found necessary during World War II. The many different engines and transmissions used for the various vehicles in World War II required a huge supply of spare parts, and made maintenance and training of personnel extremely difficult.

Compatible cross-drive transmissions were developed concurrently with the engines.

World War II vehicles had makeshift powerplant components utilizing existing engine, transmission, brake, and steering systems. Each of the powerplants required special maintenance procedures and special training of personnel on procedures for removal, maintenance, and installation.

The concept developed after World War II used an independent complete power system. The 1790 powerpack with minor modifications can fit any medium or heavy tank built since World War II.

As demonstrated in the laboratory, engine life under good conditions was satisfactory; however, under field usage, improvement was required.

Aberdeen Proving Ground, in early 1953, reported that fuel consumption was high and cruising range low. In addition, operational problems were reported.

In 1955, Aberdeen Proving Ground conducted tests of the M48A1 tanks under "normal battle day operating capabilities without refueling." These tests, reflecting 18 hours of operation, were divided into 40 percent cross country, 20 percent gravel road, and 40 percent idle. According to these requirements, the M48A1 tanks, with a fuel capacity of 190 gallons, were found to have a capability of operating only 7.5 hours and 54 miles under these criteria. To fulfill the requirements would necessitate the use of 488.5 gallons of fuel.

Recognizing the need for improving the cruising range and also recognizing that the engine economy of the AV1790 engine could not be improved, the next best method was to incorporate a jettison-type fuel tank kit on the tank. This kit consisted of four 55-gallon drums which fed gasoline directly to the engine ahead of the main fuel supply.

When approaching a combat situation the fuel tanks, which were not armor plated, could be released from inside the tank and the tank could then proceed with a full fuel supply.

This kit increased the fuel capacity of the M48 and M48A1 tanks by 200 gallons and increased the cruising range beyond the requirement of 100 miles. The kits are easy and economical to install and are placed on all vehicles before oversea shipment.

When the M48A2 was placed in production, the oil coolers for the transmission were redesigned so that they could be moved from the sides of the engine to the top. Thereafter, that space was utilized for more fuel which increased the supply and cruising range of this vehicle on one filling of gasoline. About 23 percent of the M48 series tanks have this latter capability.

Engines using diesel fuel have been designed and incorporated into production of the M60, the cruising range of which is allegedly about three to four times that of the M48 and A1. Diesel was not used for engines in the M48 series, according to the Army because of War Department directives, followed by the Department of Defense, which restricted the use of diesel fuel. These directives have been rescinded.

While awaiting the replacement of the M48 series tank with the new diesel-engined M60, the Army and the Marine Corps remain saddled with a short-ranged vehicle and the fuel supply problems attendant thereto. Adding more capacity to the tanks did little to solve the overall problem of supply. It merely made it possible for the tanks to need refueling less frequently. The total amount of fuel needed for operation remained the same.

This approach to the problem is faintly reminiscent of the situation in which the modern day automobile driver finds himself—with the advent of greater horsepower, the miles-per-gallon decreased and the size of the gas tank increased. Not having to fill up the gas tank any more frequently than in the past gives a false sense of accomplishment when compared with the greater "get up and go," when, in fact, there has only been a trade of horsepower for mileage.

Obviously there was a need in the new tank for an engine of greater horsepower since, among other things, a portion thereof had to be directed to the operation of the oil coolers for the new automatic transmission. In addition, the new power pack of the M48 became the source of energy for all powered operations of the vehicle.

A 1-horsepower auxiliary engine was installed for communications purposes to allow the main engine to be shut down at certain times and thus to conserve fuel. While this has been of some assistance, it has not served to correct a serious situation. It is noted that Aberdeen Proving Ground reported in 1953 that the fuel consumption of this power package is approximately one-half of that of the comparable World War II tank.

While we agree that the desirable features attained by the use of this power package (easier and less fatiguing operation, standardization of parts, greater maneuverability and the like) are praiseworthy, we wonder whether the same or approximate features might not have been realized without "paying the piper" his price of decrease in cruising range.

Commander's cupola

The commander's cupola, which in this instance also serves as a mount for the M2, .50 caliber machinegun, is the component that fixes the battle station of the tank commander. It is located on top of the turret and is the place from which the commander performs all his duties and issues the orders. It is the nerve center of the tank.

At beginning of production of the M48, a Chrysler-type dual purpose cupola was utilized. Although the machinegun on this cupola could be fired with the cupola closed, it could be reloaded only when the cupola was opened. All M48's are equipped with the Chrysler cupola.

Subsequently, during production of the M48A1, the Aircraft Armaments cupola, model 30 (M1) was placed in production. Previously produced M48A1 tanks were modified to accept the M1 cupola. The M1 was designed to allow firing and reloading of the machinegun with the cupola closed.

Development of the M1 cupola began late in 1951 and the work was turned over to Chrysler in September 1953 for release to immediate production. Redesign and modification of this cupola began immediately. GAO alleged that premature release resulted in about 150 design changes in the next year. Modification was still being performed in 1958 and 1959.

The GAO presented a copy of a 1955 letter from Chrysler (VEA) to OTAC regarding the major deficiencies in the M1 cupola which prevented its immediate release to production.

Chrysler pointed out that when the original drawings for the M1 were received at Chrysler, some redesign was necessary and complete production design checking was required.

By way of explanation, the Chrysler letter stated:

> Due recognition should be given to the fact that this was a rush program of releasing a relatively undeveloped component to production. Insufficient time had been allowed to fully develop the model 30 cupola and all its components, and to incorporate these changes into drawings. The rush of placing this item into production added to later changes to the initial release.

The M1 cupola was tested after release to production by the Army's regular testing bodies.

The Army in its reply to the GAO allegations as to the design changes in the M1 cupola pointed out that in order to reduce the lead-time required for production of the cupola, a decision was made to release it "piecemeal". Major castings (long lead items) were released first followed by additional releases as they became available. Approximately 150 supplements to the production order were issued to release the remaining parts of the cupola to production. The Army stated that the GAO misinterpreted these partial releases of engineering change orders as design changes.

According to the Army, a group of deficiencies was made known in a Fort Knox test report dated March 24, 1953. Recurrent reports on deficiencies were made by Aberdeen Proving Ground in 1955 and Fort Knox in 1956 and 1957.

In February 1957, the U.S. Army Armor Board reported on its test of the M1 cupola and concluded, (1) that the cupola as tested is not suitable for Army use, (2) there are inherent design deficiencies, not correctable by modification, (3) that upon correction of those de-

ficiencies that can be corrected, the cupola would be considered as an interim item of use.

On the basis of this report, CONARC, in March 1957, recommended that all previously produced M1 cupolas be modified to correct the 17 deficiencies noted. In May 1957, the Chief of Research Development of the Department of the Army approved this recommendation.

Using forces in Europe experienced difficulty with the cupola and applied some field fixes. Representatives of OTAC went to Europe to review the problems and the fixes.

Minutes of meetings held at Chrysler in the late summer and fall of 1957, between the Army and the VEA relative to this matter, disclosed that a new cupola, the T9, was planned for production of the M48A2. OTAC stated, however, that the T9 cupola had not at that time been approved for production. (M48A2 tanks began rolling off the production lines in June 1956.) A representative of the Armor Board in commenting on this situation, stated that—

> the T9 cupola is only slightly better than the M1 cupola. The M1 was made to fit an existing hole in the turret. The T9 will be just as small and fit the same hole. Until you get some room to work in, you will still have an unsatisfactory cupola.

The Army advised that a modification program correcting major deficiencies and improving the operation of the M1 cupola was released by a modification work order dated June 19, 1958, supplemented on July 14, 1959.

The Army further stated that there have been no unsatisfactory equipment reports from the field indicating that these modifications were not effective.

There is a basic and uncorrectible deficiency in the cupola—insufficient room in which to work. When additional components of the machinegun were moved inside the cupola, upon change from the Chrysler type to the M1, more crowding occurred making it extremely difficult for the tank commander to operate from a "buttoned-up" position.

Tank crews interviewed by members of the subcommittee were unanimous in their position that this cupola was so small that it was almost impossible to use the .50 caliber machinegun.

The tanks utilized by each of these crews had cupolas on which the latest (1958) modifications had been installed. Nevertheless, they persisted in their views that these modifications had little effect on the usability of the M1 cupola and the machinegun.

Many never used the machinegun and those who did advised that they seldom reloaded. After using up the 50 rounds with which it is usually loaded, they thereafter ignored it, finding it extremely difficult to reload when the tank is standing still and virtually impossible to reload when the tank is in motion.

It should also be noted here that when the machinegun mechanism was moved inside the cupola, the gun was changed from a vertical to a horizontal position. This resulted in numerous "jams" in the gun and added to the difficulty of reloading. In addition, lack of space necessitated changing the ammunition feed box from 105 rounds to 50. This made the necessity to reload more frequent.

The Marine Corps, users of the M48 and M48A1, advised that they, too, have found the space too small. However, by reason of intensive

training are able to use it to some extent. At Camp LeJeune, the Marines have successfully tested a locally devised installation of a .30 caliber machinegun on the cupola of the M48A1. The results of this test were forwarded to the Marine Corps Test and Development Center at Quantico, Va., but no action has resulted to date.

In its production of the M60, the Army has installed a larger cupola with a .50 caliber machinegun (M85). This gun is equipped with a shorter receiver which does not project into the cupola as far as the present M2.

Upon receipt of this information, the subcommittee directed the Army to ascertain what action, if any, had been made toward retrofitting the M48 series tank with the M85. The following was received in reply thereto:

The Army has investigated the possibilities of retrofitting the M1 cupola on the M48 series tanks with the new M85 (then T175) short receiver .50 caliber machinegun which was then under development for future combat vehicles. This gun is the first U.S. machinegun development specifically for use in combat vehicles. Prior to this time the machineguns used in combat vehicles were weapons designed originally for infantry use.

Actually two studies have been made; the first with an objective to design a modification kit susceptible of application at the field maintenance level and the second without this limitation.

As a result of these studies, it has been determined that, although it is physically possible to install the new gun in the M1 cupola, the problems experienced with the present M2 gun would not be substantially eliminated. That is, the reduced ammunition capability plus the difficulties encountered in servicing the gun and the feed and ejection problems would remain. This situation arises out of the design of the cupola itself; its limited internal volume and the location of the spent brass ejection chutes.

Compensating idler

A weakness in the suspension system; that is, a deficiency in the compensating idler spindle, causes the tracks to fall off in rough terrain when the spindle becomes loose and breaks.

This spindle, which is on all M48's and M48A1's, was reported as a weakness in original testing. Failures in the spindle were first reported by Fort Knox in 1952 and 1953, and by the Aberdeen Proving Ground in 1953 and 1954. On receipt of notification of failure, engineering studies were initiated to evaluate methods of eliminating the deficiency.

The first modification retained the existing assembly and called for a steel sleeve and shims to be inserted when the idler became loose. This was tested and reported to be satisfactory by Aberdeen Proving Ground in December 1956. In addition, testing revealed that regular tightening of the flange bolts would assist in preventing the idler from coming loose and the users were so instructed.

An improved idler arm was developed and incorporated into production of the M48A2.

Army documents, presented by the GAO, indicated that the spindle deficiency was considered as critical in 1955 and 1956.

Using forces in Europe, in 1957, reported that it had reduced the critical nature of this deficiency by (1) drastically reducing utilization of tanks, (2) largely restricting them to on-the-road operations, and (3) improved preventive maintenance. Also mentioned was the fact that an expedient had been applied to many of the spindle flanges; that is, they were welded to the hull.

The report from Europe concluded that correction of the deficiency to improve vehicle durability and combat dependability, as well as to reduce maintenance costs, was considered as mandatory if the tanks were to stay in service.

Using forces in Europe reiterated this view in March 1958, together with a recommendation that consideration be given to making the modification available to MAP recipients of M48A1 tanks.

Based on field and other reports, Ordnance Tank-Automotive Command programed a complete modification on these tanks at a cost of over $56 million. This was later reduced to about $11 million by eliminating nonessential items, reducing man-hours and restricting the modification to M48A1's only. However, a more thorough review of the entire problem indicated that the modification could not be justified in view of the cost.

At present, the Army is following a practice of replacing the same item at a greatly reduced cost, and where necessary, reboring and rebushing the hull, which is often damaged on failure of the compensating idler assembly.

To the extent that this is necessary, we find it difficult to escape the feeling that it is a case of sending good money after bad. In view of the excessive cost of modification, it is probably the only decision that could have been made.

The stereoscopic rangefinder

A stereoscopic rangefinder is a binocular instrument which provides the observer with two magnified views of the target. When the observer fuses his right and left eye views of the target and reticle, he perceives a single target and single reticle in relative depth. The observers task is to turn a range knob until the reticle is apparently at the same depth as the target, whereupon the range is read from a scale.

Early Army studies on visual estimation ranges and tank gunnery problems revealed the need for the development of rangefinders suitable for incorporation in the fire control systems of tanks. This was based on a determination that visual ranging resulted in about 15 to 17 percent accuracy.

In 1947, an Army ground forces board recommended that the stereoscopic-type rangefinder be consider far superior to the invert coincidence type (the merging of two images) rangefinder for tanks.

This recommendation was based on a conclusion that "a stereoscopic rangefinder presents no excessive problems in selection or training observers."

Accordingly, development of tank-mounted rangefinders in the Army was, with one exception, limited to the stereoscopic type. The one exception was the T43 coincidence type which, according to a CONARC report dated October 2, 1956, was designed for the M47 tank. Actually, the M12, a stereo rangefinder, was produced and installed in the M47 and the T43 continued in the development stage.

The M48A1 and M48A2 were equipped with the M13 stereo rangefinder which CONARC describes as essentially the same as the M12, although a better instrument.

Following the issuance of the M48 series tank to using troops, reports were received by the Army reflecting that difficulty was being encoun-

tered in the use of this rangefinder. These reports, verified by troop surveys, revealed that an inordinate amount of time was needed to achieve and maintain a proficiency in the use of the M13. According to CONARC—

> units, even in peacetime, cannot devote enough time to training and practice to develop in tank crewmen the skill and confidence required to operate a stereoscopic rangefinder. As a result, tank commanders are prone to rely on visual range estimation despite the fact that surveys show that most of these men realize that the rangefinder is more accurate.

Following tests, which CONARC described as—

> the first direct comparison of the stereoscopic and coincidence-principle rangefinders in the same type tank—

It was determined that—

> the T43 possesses major advantages over the M12. * * * Training is simplified with the T43 and the operator's performance, at least in the early stages, improves faster with the T43 than with the M12. Moreover, all personnel can be trained on the T43 whereas the percentage of men who can be taught to use the M12 is limited. * * * ranging and firing can be accomplished more quickly with the T43 than with the M12. In comparison, experience in the field has shown that an excessive amount of time is required to perform the ranging operation with the M13.

Successful testing of a rangefinder which consisted of the coincidence-principle of the T43 and the housing of the M13 resulted in a recommendation, in March 1959, that the modified M13A1, as it was designated, be classified standard and incorporated into future production of the M48 series tank. This was accomplished for one-third of the production of the M48A2.

As of the date of our hearings, there had been no general retrofit program for rangefinders in the M–48 series tank. The M60 is equipped with the M17 coincidence rangefinder but M48 series tanks in the hands of using forces retain the stereoscopic rangefinder, except as noted above.

Our interrogation of tank crews verified the inference in the CONARC report that the troops are not using the stereoscopic rangefinder. They find it difficult to become proficient in its use and consequently are generally relying on visual estimation for their firing of the 90 millimeter gun.

When questioned about the coincidence rangefinder, most of them replied that they had never seen or heard of it. These crews were not trainees. They were members of a STRAC outfit.

The Marine Corps was not as sweeping in its condemnation of the stereo rangefinder except that they found it requires considerably more training and a higher degree of skill to operate.

This, perhaps, speaks more for its program of training vis-a-vis that afforded by the Army.

We do not question the quality of this article and its capability to deliver the best results to the user if properly operated. But the plain fact of the matter is that generally the users do not have confidence in their ability to perform well with it and, as a consequence, do not use it. This is in accord with the Army's own report from CONARC.

In view of this situation, we are dubious of the degree of rapport between the Ordnance Corps, which has the responsibility of supplying the best possible weapons to the users, and those elements of the Army in charge of training the troops in the use thereof.

Subcommittee observations

The Army, backed up by statements of its field commanders, testified unqualifiedly, that it believes the M48 series tank to be "a good, fightable tank."

In view of the importance of this item of equipment in our arsenal of weapons, we fervently hope that this is true.

We are constrained, however, to view the overall picture through glasses that are not so rosy and to believe that certain qualifications must be made before this can be viewed as a completely acceptable position.

Prior to setting forth our views on this situation, we would like to comment on the presentations that were made to the committee.

We were much impressed with the fact that the GAO, in the main, backed up much of its testimony with official documents of the Army or the contractor. The contents and import thereof cannot be ignored.

The Army, although it acknowledged the validity of these documents, took the position that their contents were "misinterpreted"; that the statements contained therein were those of "junior" or "enthusiastic" officers, prone to exaggeration; or that many of the "corrections" requested by using forces but not applied were of the "nice to have" as opposed to "necessary" variety.

With this position, we do not completely agree. The documents speak for themselves. They present an eloquent picture of a widespread, concerted and sometimes harried effort by the Army to procure a vehicle which would measure up to the requirements of modern warfare.

In addition, however, they also tell a story of volume production, from unfrozen designs, of a virtually untested vehicle which, it was hoped, could be modified to overcome any deficiencies subsequently found by testing—testing which was to run concurrently with production.

That the Army never gave up in its attempts to achieve the ultimate vehicle, is not to be denied. The final emergence of the most recently produced M60 medium tank, is a testimony to these efforts. Those who have viewed and operated it are lavish in their praise. Undoubtedly, the Army is still not satisfied with its latest acquisition and will continue to strive for what might, at this point in time, be considered unattainable.

The welfare of this country might well rest on the results of these efforts.

But to refer to that view of the GAO presentation which disclosed the fact of volume production of a vehicle with many new, untested components.

It is unfortunate that this activity must be viewed in hindsight for such a procedure invariably creates the impression of Monday morning quarterbacking. Be that as it may, since the deed is done, it is the only possible avenue open to us for review. If thereby we can prevent any future importune activity, we will have served our purpose.

To be critical merely for the sake of criticism, is of no avail. If we are constructively critical, we will have served the purpose for which we were appointed.

In retrospect, it is obvious that once again, in 1950, we as a nation found ourselves awakening to our shortcomings in the midst of a crisis.

Our "family of tanks," recommended by the Stillwell Board, was still on the drawing boards.

In an effort to get something in the field of combat, the Army went into production of the M47, a composite of the previously produced M46 and the T42, the medium tank of the Stillwell Board recommendation.

Subsequently and almost concurrently, contracts were let for the design and procurement of the M48 tank which was to contain some of the features of the M47 (engine, transmission, and basic suspension system) as well as many new, desirable features.

Some of the desirable features were never attained. Others were attained or closely approached only by a continual process of "cut, fit, and try."

According to Army testimony and documents, the M48 was to be an improvement over the M47 in the following features:

(1) Less weight (not more than 45 tons);

(2) Turret with improved slopes and an elliptical hull for better ballistic protection;

(3) An 85-inch turret ring to provide for more crew operating space and later, a larger gun;

(4) A quick-change gun tube feature;

(5) A wider track for better flotation;

(6) A reduction in the crew from five to four;

(7) A dual purpose cupola machinegun providing antiaircraft and ground fire.

The Army's intention to restrict the weight of the M48 to "not more than 45 tons" was never realized. Its present weight has been variously given as from 49¼ to 50¾ tons. Failure to achieve the 45-ton maximum is attributed to unexpected and unlooked for increases in the weight of the hull, the turret assembly, track and suspension system, powerpack, final drive assembly, and miscellaneous components.

The Army contended that since the hull of the M48 was of a single cast and required definite thicknesses in certain areas, that the foundries were unable to completely control the weight of the final product. The single cast (one of such size had never before been produced) was thicker in some areas than it needed to be which made the tank heavier.

It is to be noted, however, that only 71 percent of the M48 and 48A1 hulls were of a single cast. The remaining 29 percent were multipiece hulls. In its testimony, the Army made no effort to indicate that any action was taken to reduce the weight in those tanks using multipiece hulls.

As to the increased weight of the track and suspension system, some of it was due to "beefing up" its components to take care of the added weight in the hull.

The turret of the M48 does have slopes in its armor which apparently improved the ballistics protection over that offered by the shape of the M47. But why could this "improved ballistics protection" not have been introduced into production of the M47 without going to a new producer?

If a larger turret ring, such as was provided in the M48, was needed, it does not seem unlikely that the casting of the multipiece hull of the M47 could have been changed to incorporate this feature and to accept this new turret.

The hull of the M47 was V-shaped made up of armor steel castings, plates and sections welded together. The hull of the M48 is elliptical.

It is reasonable to believe that the elliptical shape of the hull of the M48, would provide better ballistic protection from frontal assault because of its shape. We question, however, the need for a costly new production to attain such an objective in view of the fact that data in the committee files reflects that the M47 and M48 are virtually equal in protection qualities.

It was the casting of the hull of the M48 in a single piece which, according to the Army, caused added and unexpected weight to this item of equipment, with the resultant difficulties which might logically be expected from such an occurrence.

Apparently the elliptical shape was obtained by the use of multipiece hulls in the case of the 29 percent which were so made, and it is not clear that any action was taken in this regard in attempting to reduce the weight of the hull and to take the strain off of those components affected by the added weight. In fact, it appears that the Army completely disregarded or did not recognize this as a possible improvement and step toward attaining one of its stated objectives.

The Army did reduce the number of the crew from five to four. However, since the position eliminated was that of assistant driver, it is not clear that the reduction can be attributed solely to the production of the M48.

The institution of the quick change gun tube feature was apparently very successful. However, as to the installation of a larger gun, there is no indication that serious consideration was ever given by the Army to the installation of a larger gun on this vehicle.

The Army already had under contract for production a larger gun tank (the M103, 120 millimeters). The need for a tank with a gun larger than 90 millimeter apparently still exists, as evidenced by the fact that the new M60, now in production, mounts a 105-millimeter gun. But for reasons known only to the Army, this expected feature of the M48 was never realized. The M47 and the M48 still have the same capability in the area of firepower.

Both the M17 and the M48 carry a 50-caliber machinegun atop the turret. In the former, it must be loaded and operated from outside the commander's cupola.

With the advent of the M48, it was possible to operate the machinegun from inside but reloading made it necessary for the commander to expose himself to enemy fire. The new M–1 cupola provided protection during both operations, since its gun mechanism was brought inside the cupola, and was installed on the M48A1 and A2. However, this action did away with the possibility of providing antiaircraft fire, because the degree of elevation could not now be obtained due to obstructions inside the turret. This particular result is perhaps of no real consequence now in view of the speed of jet aircraft making it virtually impossible to get a "bead" on such aircraft in sufficient time.

The major difficulty encountered by bringing the machinegun mechanism within the cupola was that of crowding too many com-

ponents within too little space. This is evident by the fact that tank commanders and other crewmen, who are to use this machinegun, were virtually unanimous in their testimony that because of the lack of space they find it virtually impossible to reload the gun after exhausting the ammunition which they loaded in the gun prior to starting on an exercise. In addition, because the gun was changed from a vertical to a horizontal position, it "jams" more frequently and, largely, is considered ineffective. Even with the hatch of the cupola opened, we were informed that operation of the machinegun was not much better.

The Army admits that retrofit of the M4 cupola with the new shorter receiver .50-caliber machinegun, the M85, would not solve this problem because of the limited internal space of the M1 cupola.

The wider track (28 inches), for better flotation, installed on the M48 series tank was somewhat discredited by the testing of pilot vehicle No. 2 at Aberdeen Proving Ground in January 1953.

APG compared it with the previously used width (23 inches) and made several significant observations: From a transportation standpoint, it added 120 man-hours of operation because of the necessity to disassemble for rail shipment and reassemble at destination; it made the tank heavier and caused about a 10-percent increase in the use of fuel both in low and high ranges; and test areas negotiated at Aberdeen did not reflect that the wider track afforded any great advantage.

One of the items "borrowed" from the M47 was the installation of a stereoscopic rangefinder for the tank commander. Prior produced tanks depended upon visual sighting.

In 1947 the Army had decided that a stereo rangefinder was superior to the coincidence type, and its use, from a training standpoint, was not outside the capabilities of a good-sized company of men. Subsequently, however, this capability determination was found to be, if not invalid, at least not justifiable on the basis of reports and troop surveys, which revealed a lack of use by troops and the reasons therefor.

Ordnance then came up with an article, the coincidence rangefinder, which apparently overcame the objections of the troops and applied it to those tanks then in production. In accordance with established procedure, it is assumed that a determinattion to retrofit all previously produced tanks with the new rangefinder was rejected for monetary or other reasons. What then was done about stepping up the training of those men who would have to continue to use the stereo rangefinder?

From our questioning of the users, the only conclusion we can draw is that nothing was done. This is a deplorable situation and one which we find difficult to understand. It is especially disturbing when consideration is given to the fact that this rangefinder and the capability of the user are directly proportional to the successful operation of the prime purpose of the tank, the firing of the main armament.

In essence, then, the Army fell far short of its desired goals in the new production. With the exception of the M1 cupola and the stereoscopic rangefinder, these goals appear to have been, for the most part, of the "highly desirable" rather than "absolutely necessary" category. But why were they not attained? Surely, there must have been some hope for and a reasonable assurance of success, else the

project would not have been funded. This was not shooting for the moon or trying to put a man in space. This was not the production of an article resulting from pure research and development as we know it. It was the evolution of an article already in production. Army engineers are well versed in this type of design and the Army testified that the civilian producers still had in their employ engineers who had gained experience in similar production in World War II. The results speak for themselves.

The oft-repeated and familiar explanation of the Army for failure to attain these objectives is that "the state of the art" had not sufficiently progressed at that point in time to make success possible.

Additionally, what of the Army's decision to attempt to incorporate so many new, untested features from unfrozen designs in one production package? There is no question that it led to a costly modification program.

Whether the deficiencies, which generated the need for modification, were excessive, considering the emergency of the development-production program, the subcommittee will not undertake to judge. We realize that this was no ordinary military procurement. A tank is not an item that can be bought off the shelf or produced on demand at a moment's notice. Nor can the production line or flow of components be shut off like a spigot without serious disruption of the entire process. It must continue to flow smoothly.

Isn't this then a compelling reason for greater than usual caution in procurements of this nature?

The pitfalls of irrevocable decisions which normally exist at all times are greatly magnified in number and consequence in a period of crisis. There is no question that "something" is better than "nothing." But, if that "something" could or should have been a vastly improved product simply by the institution of more than ordinary caution and controls, which a prudent executive should recognize as needed at such a time, then those responsible for the failure to apply such controls have not been diligent in performing their mission. We do not question the sincerity, integrity, or dedication to purpose of the Army or the manufacturer in this process. We do raise a question, however, as to the adequacy of thought and attention that was expended therein.

The Army asserted that it was diligent, that the manufacturer was highly motivated and that it does not believe that additional thought and attention to the problems posed would have caused the decisions to be otherwise.

Here we must pause to examine this attitude in the light of the situation at hand. First, the Army justified its "rush" into production on the basis of the lack of "time." Subsequently, with the advent of the Korean truce, it was able to divert tanks from shipment to using troops and hold them in storage to await needed modification. This "pause" in the conflict also provided an opportunity for modification of tanks already issued. Now it says it has "good, fightable tanks" and offers as proof the tanks which it has had "time" to modify.

But what if this "time" for modification hadn't been available? What if the Korean conflict had spread into a much larger affair and the unmodified tanks had had to be used in combat? Would they have been useful? The Army emphatically says, "Yes."

We wish we could agree with this position and although we would not undertake to deny it, some question has been raised in our minds by statements found in the Army's test reports and related documents. For example, the Aberdeen Proving Ground Automotive Test Report of Pilot Vehicle No. 2, referred to above, reported that—

> The vehicle possesses many satisfactory features, however, many components are unreliable, unoperable or difficult to maintain.

The fact that "time" subsequently became our ally made it possible to modify this tank and to correct to a very great extent the situation which made possible such a statement.

Of real and immediate concern to us is the extent to which reliance on sincerity, integrity and dedication to purpose is substituted for the exercise of good judgment, caution and control within the Department of the Army.

Various command decisions were reportedly arrived at in the course of the production of the M49 series tank but due to the unavailability or lack of the records of these decisions, the Army found it impossible to reconstruct with any accuracy the underlying reasons for these decisions.

In view of what we have seen and heard in this proceeding, we strongly urge the Army to look within itself and closely examine its procedures. Complacency in this matter could result not only to the detriment of the Army but conceivably to the Nation as a whole.

Recommendations

(1) The Army should take immediate steps to insure that every person charged with the responsibility of operating the stereoscopic rangefinder in the M48 series tank is fully capable and qualified: or, if sufficient personnel cannot qualify, serious consideration should be given to retrofitting a sufficient number of tanks with the best possible rangefinder which using troops can operate.

(2) Inasmuch as retrofit of the M1 cupola with the M85 machinegun will not eliminate to any substantial degree the present difficulties encountered in operating the M2, .50-caliber machineguns, the Army should undertake to study the "successful test" at Camp Lejeune of the installation of a .30-caliber machinegun. Such a study should enable a proper decision as to whether M1 cupolas now in use should be equipped with the .30-caliber gun.

(3) The Army's records system in the tank-automotive field, including its purposes, should be most carefully reviewed and thoroughly analyzed on an individual and collective basis to determine whether instructions are being fully implemented and whether the system is actually accomplishing the purposes for which it is intended. This study should also determine the extent to which this system is correlated with supply and maintenance data and the effect this correlation has on the attainment of the ultimate benefits expected to be derived from the system. Consideration should be given to feasibility of incorporating into this system a vehicle log book similar in content and scope to that utilized by the Marine Corps.

(4) The work of the VEA field representatives should be assimilated into the Army's reporting system and handled "in house" as soon as practicable.

(5) A workable system of followup by OTAC on modification work orders should be devised and instituted at once.

(6) In view of the extent of required maintenance in this field, the Army should minutely analyze the scope and vigor of its programs of research, in house and out, to eliminate or substantially decrease this requirement, in an effort to determine the adequacy thereof. During this analysis, specific attention should be directed toward determining to what extent there has been a tendency to rely on advances in the state of the art in the automobile industry to solve these problems.

(7) The decision-making process within the Army that makes possible the continued incorporation into production of difficult-to-use items such as the stereoscopic rangefinder and the M1 cupola, to the extent that retrofit is either too expensive or unavailing of benefit, should be thoroughly scrutinized and changes made where necessary. We are not aware of the extent to which this process may extend to other vehicles acquired during or subsequent to the Korean conflict but have no reason to believe that it is not all-inclusive.

APPENDIX

SUMMARY OF GAO REPORT

The Department of the Army has procured nearly 19,000 combat and tactical vehicles, valued at about $1.6 billion, exclusive of spare parts and modification costs, which have serious deficiencies, particularly in the engine, transmission, and track and suspension system areas. Procurement of these vehicles resulted from a practice of contracting for volume production prior to adequate assurance that identified defects could be corrected during production or by subsequent modifications. Although extensive and costly modification programs have been undertaken to correct deficiencies, the vehicles still contain serious deficiencies in the same areas.

Records are not maintained by the Army to show the total investment in each vehicle program. The Army records which do exist indicate that in addition to procurement costs, modification costs were about $130 million; however, this amount reflects the modification costs for less than one-half of the vehicles produced under the programs reported on and was computed at a point in time before all the needs for modifications were ascertained. It was not practical to determine the value of spare parts necessary to maintain the specific vehicles mentioned in the report.

The Army has continued to procure vehicles without an adequate means of evaluating the effectiveness of vehicles produced under similar circumstances and, therefore, without an effective basis for corrective action. Basic vehicle utilization and maintenance records at the using troop level, which were maintained by the vehicle engineering agency (a contractor) and by the military installations, provide information required for complete knowledge of the performance of the vehicles and for effective management of the vehicle programs. However, no concerted and systematic methods were followed in accumulating or coordinating and analyzing basic data or in providing it in usable form to higher levels for management purposes.

Each of the nine series of combat and tactical vehicles included in the report contained defects which seriously impair its operation and maintenance. Many defects were found in initial prototypes and throughout production, particularly in the engine, transmission, and track and suspension system areas, and some deficiencies continue to exist in each of these areas in vehicles now in use by troops despite extensive and costly corrective efforts during the lengthy periods of their development, production, and modification.

In general, the major defects adversely affected the following areas for each vehicle series:

1. Automotive capabilities—durability of engines and transmissions, capability of track and suspension system to perform

on rough terrain, and fuel capacity and cruising range without necessity for refueling.

2. Armament capabilities—effectiveness of firepower and vulnerability to enemy fire.

The following table summarizes the vehicles included in this report:

Vehicle description	Contract period	Value (in millions)
Medium tank (M48 and M48A1)	July 1951 to May 1956	$1,249.2
Heavy tank recovery vehicle (M51)	April 1954 to March 1955	31.0
Carrier, light weapons, infantry (M274)	June 1956 to May 1959	4.2
Heavy tank (M103)	July 1951 to June 1954	64.3
Armored personnel carrier (M59)	December 1952 to February 1960	202.1
Self-propelled mortar carrier (M48)	May 1956 to May 1958	21.7
10-ton truck tractor (M123)	June 1952 to May 1957	10.9
Self-propelled 106 mm. multiple rifle (M50)	August 1955 to September 1958	11.2
Semitrailer—electric van (M348A1)	To February 1957	.8
Total		1,595.4

Effects of an inadequate program for testing and proving vehicles

Under the present method for initiating a new vehicle program, the Ordnance Corps awards design-development-engineering contracts. In accepting the work of the contractors for production purposes, Ordnance also accepts the results of the development phases of the program, including engineering and design changes proposed as a means of correcting defects which are found to exist at this stage. The proposed engineering and design changes to correct defects are evaluated on the basis of paper studies without any actual demonstration as to the degree of their practicality and effectiveness. Consequently, acceptance of the results of the development phases of the program and the proposed corrections have the effect of committing the Ordnance Corps to a weapon system before it has sufficient information for reasonable assurance of obtaining a satisfactory product.

Each vehicle series included in the review was accepted by the Army and often successive contracts for production of vehicles in volume quantities were awarded despite known defects or before adequate test and evaluation of initial models to determine performance capabilities. As a general rule there was no assurance that the defects could be adequately corrected by modification.

Further, repeated indications at successive stages of development and production that the original deficiencies persisted and that further deficiencies had been found were not recognized as calling for prompt termination, suspension, or reduction of volume production. Instead, in some cases additional quantities were ordered.

On the basis of the facts shown by the Army's own records, the vehicle deficiencies appear to be attributable primarily to the practice of contracting prematurely for volume production despite identified serious defects without assurance that effective corrections could be made and of relying upon subsequent modification to correct the defects. In addition, the performance specifications prescribed for the vehicles did not include standards of reliability and durability in respect to their field use.

Army's vehicle performance reporting system inadequate

The Army's means of reporting information to responsible commanders regarding the performance of vehicles are not designed to provide information showing the actual extent of deficiencies in the vehicles or the frequency or types of failures that occur during use. This is particularly true in regard to the lack of information bearing on the reliability of the vehicles.

Command and higher echelon technical officials rely for vehicle performance information principally upon (1) the official "deadline" reports, (2) unsatisfactory equipment reports (UER's), (3) field visits by representatives of higher commands and the technical branches of the Army, and (4) information received by the contractor vehicle engineering agency from its field observers. The first three means of acquiring information have the following limitation, while the fourth is not directed or controlled by the Army.

1. The official "deadline" reports are not designed to reflect the degree of utilization of the vehicles, although utilization has a direct bearing on the frequency and extensiveness of failures and consequent disclosure of deficiencies. A substantial proportion of the vehicles are undergoing relatively limited utilization; nevertheless, failures occur with regularity. There also is some evidence of omissions from the "deadline" reports; that they include neither all vehicles that are inoperative on the reporting dates nor all vehicles that have been inoperative during the interval between reporting dates but that have been repaired and returned to operation.

2. Army procedures call for the submission of UER's when a vehicle failure occurs. However, a majority of the vehicle failures which actually occurred in the field either had not been made the subject of UER's or the records covering the submission of such reports were not available. In a number of cases using troops stated that, although initial individual failures were reported on UER's repetitive failures of the same nature were not so reported. In a number of specific instances UER's were submitted to OTAC on which there was no actual correction of the deficiency causing the failure.

3. No evidence was found of any systematic procedure that would assure that all of the significant information developed at the using troops level as to vehicle performance would be made available to management. Army representatives stated that inspection reports were supplemented by letters and memorandums and by word of mouth, concerning the details of vehicle performance.

For example, only three deficiencies affecting M48 and M48A1 tanks were included among 65 deficiencies reported on UER's for all types of tanks and other automotive equipment during a full month ending March 15, 1957, whereas during a single week within the same period contractor vehicle engineering agency observers were reporting in excess of 100 deficiencies on the tank series alone. Additionally, it should be noted that the UER reports cover Army activities worldwide while the vehicle engineering agency observers report from only a part of the Army installations in the United States.

It appears, therefore, that the opinions of field commanders as a basis for concluding that the vehicles perform satisfactorily should be considered in the framework in which they are expressed; namely, the lack of any assured method of providing such commanders with comprehensive and reliable information as to the actual performance experience of the vehicles in the hands of using troops.

○